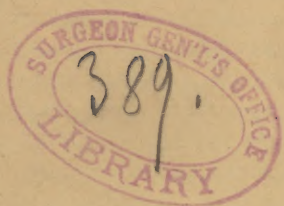
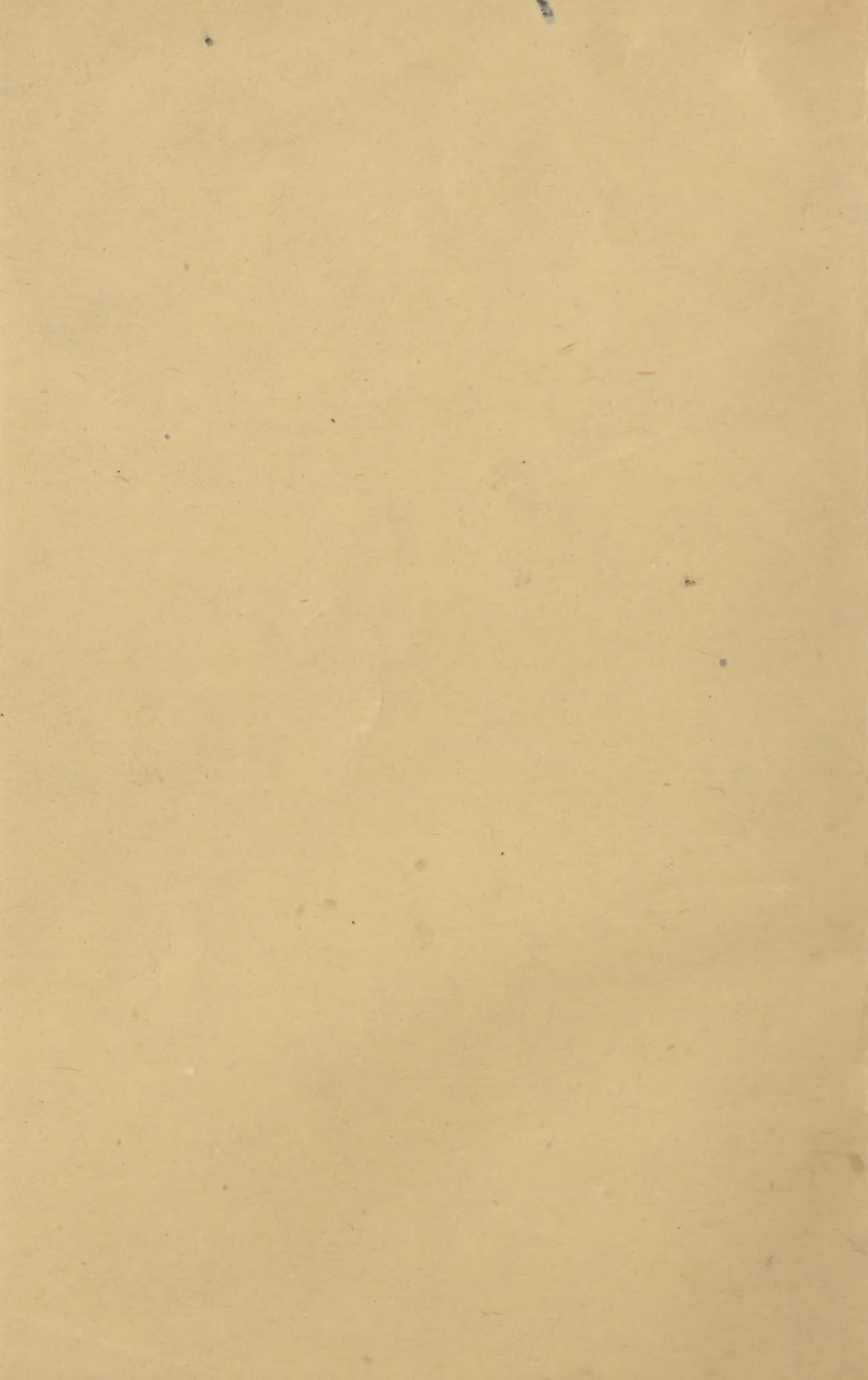


STEARNS (R.E.C.)

on certain parasites + + + +





ON CERTAIN PARASITES, COMMENSALS, AND DOMICILIARS IN THE PEARL OYSTERS *MELEAGRINÆ*.

By ROBERT E. C. STEARNS.

The presence of nodules or tubercles on the interior surface of the shells or valves of lamellibranch (bivalve) mollusks is of frequent occurrence. These excrescences are nacreous or otherwise, according to the character, in this respect, of the shell in which or upon which they occur. They are found alike in fresh-water and marine species. In the pond and river mussels (*Unionidæ*), they are chiefly due to *interior* causes; in marine forms, like the cockles (*Cardium*), mussels (*Mytilus*), the scallops (*Pecten*), etc., these formations are generally traceable to *exterior* causes. It is often the case that specimens of the large scallop of the New England coast (*P. tenuicostatus*), are so burrowed into by a species of sponge (*Cliona sulphurea*) that nearly the entire inside surface of the valves will be roughened with sharp, thickly-set pustulæ.

So, too, with the beautiful pecten of the west coast, *P. hastatus*, common in certain localities in Puget Sound. Fully one-half of the specimens obtained by the dredge are so defaced by the ravages of a similar species of sponge as to be of no value.

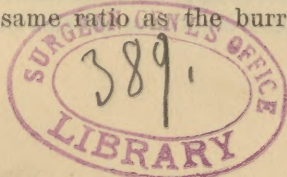
We sometimes meet with these nodulæ in the shells of marine gastropods, notably the *Haliotidæ*, popularly known as Abalones, or earshells. In all of the marine species in which these nodules occur it will usually be found that the substance of the shell has been bored into from the outside by either a species of pholad or lithodomus.

Neither of these forms are, properly speaking, either parasites or commensals.

They are, more definitely, *domiciliares*, and excavate their burrows, not for the purpose of getting at the softer parts of the mollusk upon whose shell they have "squatted" in order to use said softer parts as food, after the manner of the predaceous *Naticas* and *Purpuras*, but solely for the purpose of a residence or domicile.

The lithodomi, especially, burrow into many species of shells, and the pholad, so often found in the heavy shells of old individuals of the *Haliotidæ*, I am inclined to believe as a differentiated and dwarfed variety of a widely distributed *rock-borer*. A related form (*Martesia cuneiformis* Gray) is common on the Atlantic coast of North America, and may often be seen *in situ* in the shells of the common oyster (*O. virginica*).

The burrows of these shell-boring pholads and lithodomi are at first quite small, increasing in size in the same ratio as the burrower in-



creases in age or in growth. After a while the depth of the boring is equal to the thickness of the shell in which it has been made, and the occupant of the latter, in order to keep his own shell intact and maintain the integrity of his own domicile, commences depositing layer upon layer of nacreous or porcellaneous matter, as the case may be. In keeping pace with the continued encroachments of the domiciliary squatter upon the outside, this deposit finally becomes a more or less conspicuous protuberance.

In one of the mother-of-pearl shells which illustrate this paper (Plate I, which exhibits, as do all the figures, the *inner* side of the shell), the exterior has been perforated in both directions; that is to say, *transversely*, or at right angles to the *growth-layers* of the shell also between the *growth-layers*, the first class of perforations leading to the separate rounded nodules and the latter to the elongated form. If the reader had the shell in his hand, so that he could turn it over and examine the exterior perforations, he would at once perceive that the site of each of the nodules or tubercles exactly corresponds with the site of an exterior perforation or burrow.

In the *Haliotis* shell, the domiciliaries are a species of pholad (*Penitella parva* Tryon), and the site of each may be seen on the outside of the shell and the corresponding nodosity on the inside.

Plate I represents an adult abalone or ear-shell, *Haliotis rufescens* Swainson (Mus. No. 74877), a Californian species. The figures 1, 2, and 3 indicate the rounded elevations of nodules caused by *Penitella*, and figures 4, 5, and 6 show the ends or edges of the pholad shells, the surface of the ear-shell having been bored through or otherwise removed.

Sometimes these nodules or tubercles are due to some foreign inorganic matter, a particle getting in between the mantle of the mollusk and the inner surface of its shell. In such cases it is, we may say, at once plastered over, and thus fixed upon the surface of the valve.

Free concretions, *i. e.*, unattached or non-adherent nodules, are, as is well understood, caused by some particle, organic or inorganic, becoming in some way lodged *exclusively in the soft parts* of the body of the mollusk, and so far away from the surface of the shell as not to admit of its being cemented to it.

No doubt many of the mollusca, both gastropod and lamellibranch, contain or are inhabited by true parasites. In certain species of fresh-water mussels (*Anodonta cygnea* of Europe, and *Anodonta fluvialis* of America) a species of water mite (*Atax*) has been detected, and sometimes *Filaria* (thread worms) and other forms occur.

CRUSTACEAN PARASITES.

A small species of crab (*Pinnotheres*), an epicurean no doubt, finds a salubrious habitation in the common oyster, but parasites of *any considerable size* appear to be rather rare.

Besides *Pinnotheres ostreum* Say, the name of the species above referred

to, another small crab (*Pinnotheres maculatus* Say) is sometimes found in the common mussel (*Mytilus edulis*), and the large scallop (*Pecten tenuicostatus*) before mentioned. It is doubtful, however, whether these crabs are really parasites or only commensals, though probably the former.

Before the Zoological Society (London, April 6, 1866), Dr. H. Woodward exhibited specimens of animals, commensal or parasitic, in the pearl mussels of Australia. Among these was "a specimen of *Pinnotheres* which has been entombed in a cyst of pearl by a living pearl-mussel," etc.

He further remarked: "It seems extraordinary and beyond belief that the *Meleagrina* should of all the Conchifera be the one to resent the commensalism of the pea-crab, which has been known since the days of Cicero, Pliny, Oppian, and Aristotle, to inhabit the shell of the *Pinna* and the oyster, and has been recorded from *Astarte*, *Pectunculus*, and at least some half-dozen other bivalves, with whom it appears to live on the most friendly terms.

"It is the females, however, which constantly reside within the shells of the Conchifera, whilst the males are said to avail themselves of favorable opportunities to visit the females in their retirement.

"Whether or not in this case the unlucky male intruded himself upon *Meleagrina* at an unfavorable period, and, finding no female *Pinnotheres*, penetrated so far beneath the mantle of the pearl-mussel as to be unable to retreat, one thing is quite clear, namely, that the *Meleagrina* entombed the intruder in a cyst of pearl from which the clever pearl-button maker alone liberated him."

FISH PARASITES.

We have, however, evidence of the occurrence of fishes of two species as parasites in the true pearl oyster, or mother of pearl shell *Meleagrina*, not by the presence of the living fish, or even by dead specimens of "fish in the flesh," if we may use so convenient a paradox, but by their entombed remains in the form of nacreous nodulæ or tubercles on the shells or valves of the said mollusk.

At a subsequent meeting of the Zoological Society (June 1, 1886), Dr. Günther exhibited a specimen of a small fish of the genus *Fierasfer* embedded in a pearl oyster, and said:

"The specimen which is represented in the accompanying wood-cut of the natural size has been in my possession for many years. It is an old shell of *Margarita margaritifera*,* in which there is imbedded, behind the impression of the attractor muscle, a perfect individual of a fish belonging to the genus *Fierasfer*. The fish is covered by a thin layer of pearl substance, through which not only the general outlines of the body but even the eye and the mouth can be seen. The parasitic habits

of *Fierasfer* are well known, and Putnam describes, in the 'Proceedings of the Boston Society of Natural History,' Vol. xvi, 1874, p. 344, a species, *Fierasfer dubius*, which is found on both coasts of Central America, but inhabits holothurians on the Atlantic and pearl oysters on the Pacific side; and he further mentions, in a foot-note, an example belonging to the Museum of Comparative Zoology at Cambridge, in which also a *Fierasfer* has been imbedded in the substance of the shell. In this case, as well as in ours, the fish, instead of introducing itself into the cavity between the two halves of the mantle, penetrated between the mantle and the shell, causing irritation to the mollusk, which the latter resented by immediately secreting the substance with which the intruder is now covered. It is remarkable to note that the secretion must have taken place in a very short time, at any rate before the fish could be destroyed by decomposition."

Soon after the close of the New Orleans Exposition Prof. F. Ferrari Perez and Señor J. G. Aguilera, of the Mexican Geographical Commission, visited Washington and remained here for several weeks for the purpose of comparing and identifying various natural history material with the assistance of the curators in different departments of the National Museum.

The collections in charge of these gentlemen, so far as molluscan forms are considered, were rather meager, though many interesting points pertaining to geographical distribution were derived from the examination.

The collection included a hundred or more valves of the common pearl oyster of the Pacific coast of Mexico, *Meleagrina fimbriata* Dkr., of which two or three species have been made by as many authors. Upon examining these last winter I found a single valve (see Plate II, Fig. C), the right half of a rather young individual in which was imbedded, in very nearly the same region as in the specimen mentioned by Dr. Günther, a small fish of rather a long and slender form, probably of the same genus and perhaps the same species as that inclosed in his (Günther's) pearl-oyster valve, and previously described by Putnam, as quoted by Günther. The Mexican collection contained but a single specimen of this special character.

ANOTHER SPECIES OF FISH DETECTED.

Among the lot, however, were two or three valves, in each of which, inclosed in nacreous splendor, was a specimen of a small fish, apparently a species of *Oligocottus*.* In each instance the fish had worked its way between the interior face or surface of the valve and the mantle towards and near to the adductor muscle, as can be seen by examining the shell close by the muscular scar.

The squarish, chunky head of the little intruder, also the somewhat

* Submitted to Dr. Bean, curator of ichthyology, who, though not properly refers it to this group.

prominent spines of the head, are easily discerned, though covered and partially obscured by the coating of nacre. (See Plate III, Fig. D.)

The single specimen containing the inclosed *Fierasfer* was retained by the commission, but one of the others (Plate III, Fig. E) was kindly presented to the National Museum. (No. 73934a.)

I am not aware that the occurrence of *Oligocottus* in this way has heretofore been observed or made known.

This determination is not positive. The specimen (73934a) represented in Plate III, Fig. E, is not as favorably presented for this purpose as in the others in the possession of the commission.

The genus *Oligocottus* Girard includes certain small fishes inhabiting rock pools between tide marks on the Pacific coast of North America. The species described, and their distribution as given in Jordan and Gilbert's Synopsis of the Fishes of North America (Bulletin of the U. S. National Museum, No. 16), is as follows:

O. analis Grd., coast of California; abundant in rock pools, from Monterey southward to Lower California.

O. maculosus, Grd., San Luis Obispo to Alaska, exceedingly abundant northward.

O. globiceps, Grd., Pacific coast northward to Kodiak, in rock pools; rather rare.

Assuming that Dr. Bean is correct in placing the above in this group, it will be observed that whether it belongs to the more southern species of the three (*O. analis*) or otherwise, the geographical distribution is evidently considerably extended, as the pearl-oysters in which our specimens are inclosed came from the Gulf of California, where the fishery of these shells is carried on.

After entering the shell, which of course must be at such time as the valves are partially open or gaping, these fishes find no obstruction to their course as they push their way towards the interior between the mantle and the smooth inner surface of the valves until they approach the adductor muscle, and here they find a barrier which most likely causes them to expend somewhat greater activity or energy and consequently in a correspondingly increased degree disturb the serenity if not the structural economy of the oyster.

Having reached thus far, the invader is in the immediate vicinity of—if not the seat of intellect, then—the center of sensitiveness. The deposit of nacre in such instances must be very rapid, and it is quite possible that the unwelcome explorer is not only enshrouded and entombed in pearl, but previously drowned in a pearlaceous flood, for it may be reasonably presumed that the annoyance caused by its presence must be exceedingly great, and likely to induce a copious flow of nacreous lymph at the point and in the region of greatest irritation.

It is evident that the deposition and induration are sufficiently rapid to inclose the parasite before decomposition has taken place.

DECEMBER 15, 1886.

PLATE I.

(Fig. A.)

Haliotis rufescens Swainson (Museum No. 74877), the red-backed ear-shell or abalone of California and elsewhere, on the west coast of America (somewhat reduced).

The figures 1, 2, and 3 indicate nodules caused by the burrowing of a pholad, *Penitella parva*, and 4, 5, and 6 show other nodules, the nacreous coating removed by accident or otherwise, exposing the edges of the pholad shells, etc.

From nature, by W. H. Chandlee.

(PLATE II.)

Fig. B.

Right valve of the pearl-oyster, mother-of-pearl shell *Meleagrina fimbriata* Dunker, two-thirds natural size (a West Mexican species) showing rounded and elongated tubercles or nodules caused by perpendicular and inter lamellar perforations of *lithodomi*.

From nature, by W. H. Chandlee.

Specimen belongs to U. S. Nat. Museum, No. 73934b.

(Fig. C.)

Right valve (two-thirds natural size) of *Meleagrina fimbriata* Dkr., mother-of-pearl shell from west coast of Mexico with parasitic fish *Pterasfer* inclosed in same.

From nature, by A. Z. Shindler.

Specimen belongs to the Mexican Geographical Commission.

PLATE III.

(Fig. D.)

Right valve (two-thirds natural size) of *Meleagrina fimbriata* Dkr., mother-of-pearl shell from west coast of Mexico with parasitic fish *Oligocottus* sp. inclosed in same.

From nature, by A. Z. Shindler.

Specimen belongs to the Mexican Geographical Commission.

(Fig. E.)

Left valve (two-thirds natural size) of *Meleagrina fimbriata* Dkr., from west coast of Mexico, with parasitic fish *Oligocottus* sp. inclosed in same.

From nature, by W. H. Chandlee.

Specimen belongs to the U. S. Nat. Museum, No. 73934a.

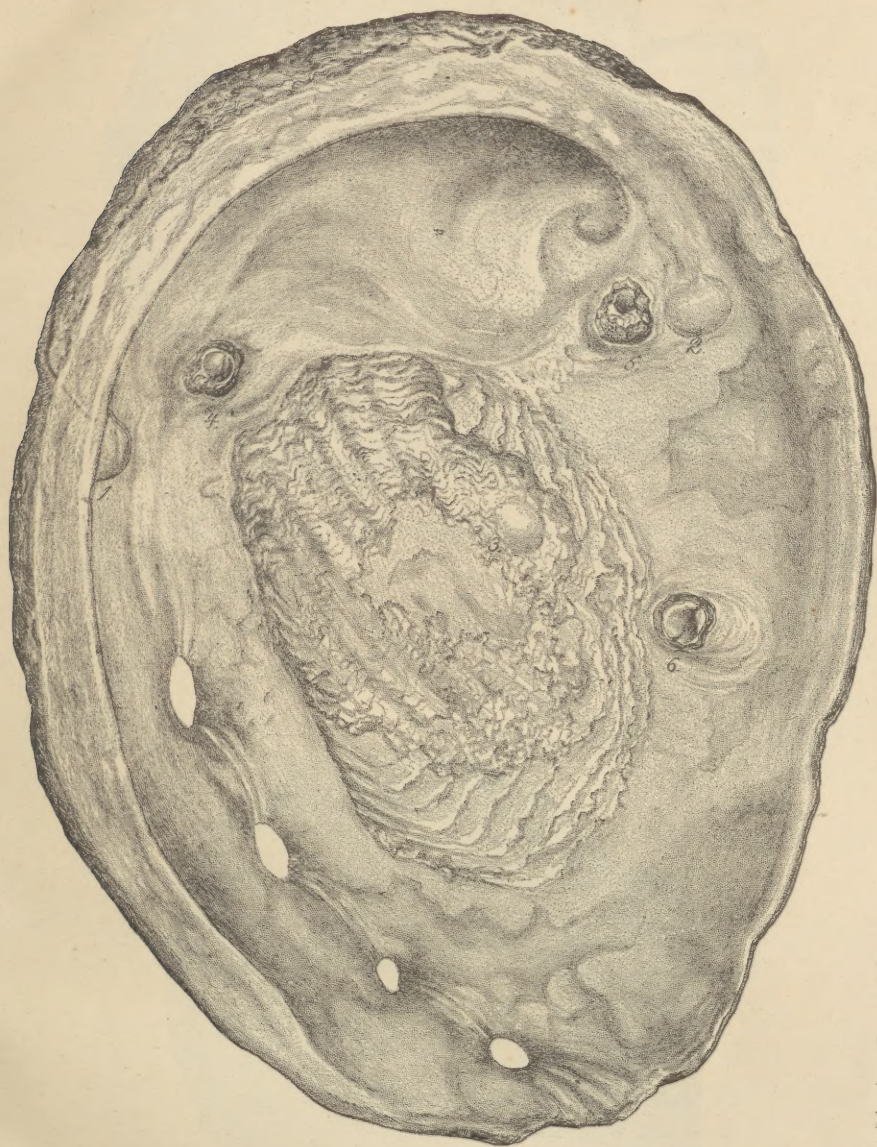


FIG. A.—*Haliotis rufescens*. (Nearly natural size.)



FIG. B.—Right valve of *Meleagrina fimbriata*. ($\frac{1}{2}$ natural size.)

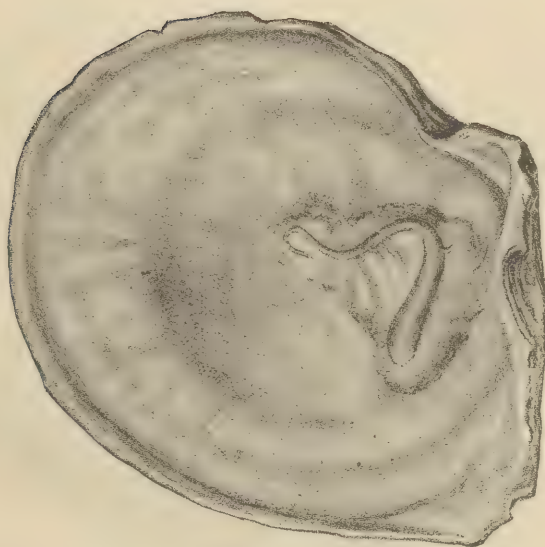


FIG. C.—Right valve of *Meleagrina fimbriata*. ($\frac{1}{2}$ natural size.)

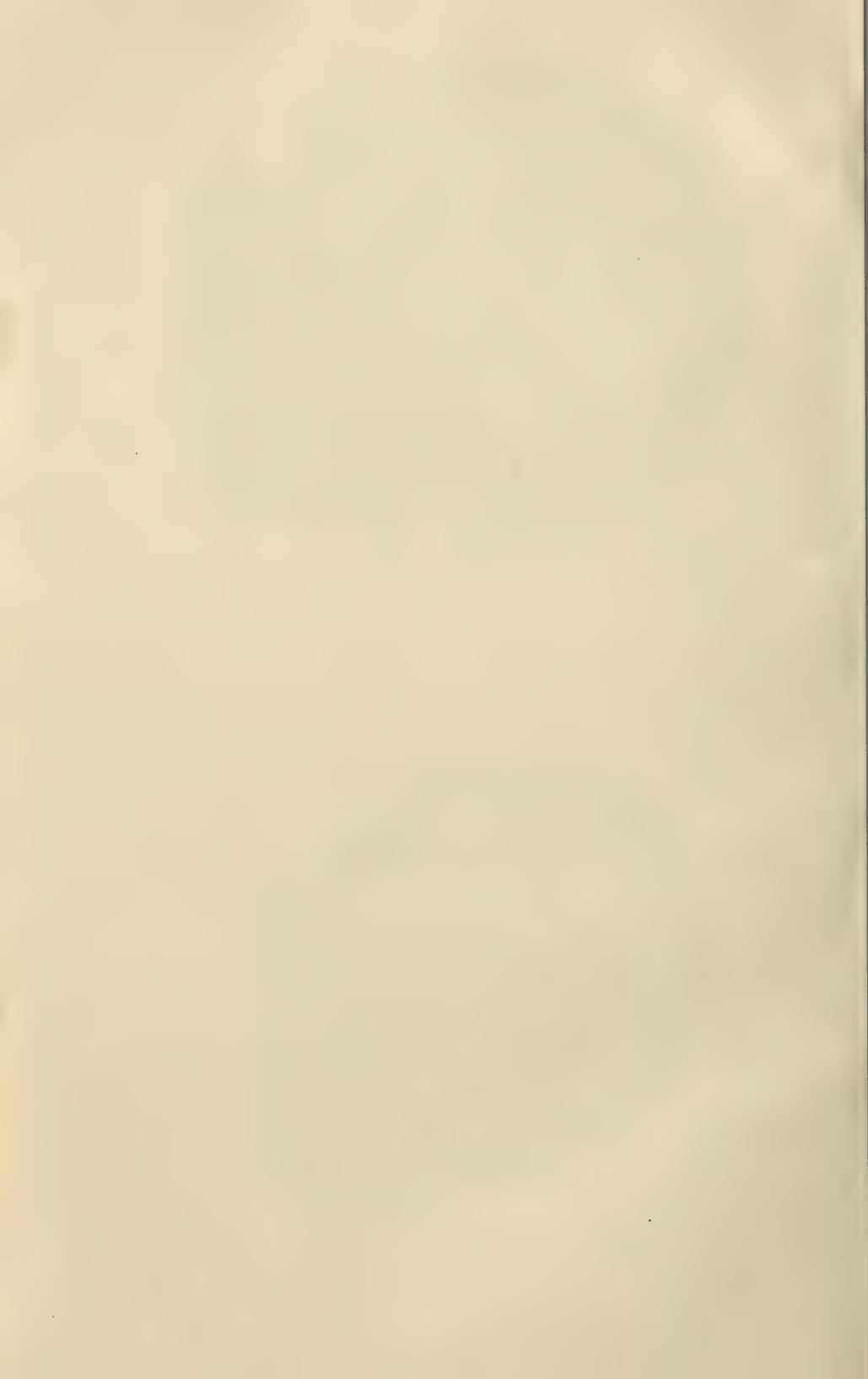




FIG. D.—Right valve of *Meleagrina fimbriata*. ($\frac{1}{2}$ natural size.)



FIG. E.—Left valve of *Meleagrina fimbriata*. ($\frac{1}{2}$ natural size.)

